Neuro Technology, Inc.

Instruction Manual for **MicroStim *Plus*** Peripheral Nerve Stimulator
Part Number: 8-1053-62

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1.0 INTRODUCTION

This manual is provided to aid the Anesthesiologists/CRNA in the operation of a *Peripheral Nerve Stimulator (PNS).*

1.1 The **MICROSTIM *PLUS*** Peripheral Nerve Stimulator is a constant voltage stimulator for monitoring neuromuscular block and evaluating muscle relaxant dosage during surgery and recovery.

Note: The **MICROSTIM *PLUS*** should *not* be used with block needles for Nerve Location (See Section 8.3). Contact Neuro Technology for special products designed for this application.

2.0 SETUP

2.1 Location of the instrument should be within six to twelve feet of the patient (depending on leadwire length) and approximately five feet above the floor to provide easy viewing of the touch switches (buttons) and indicators.

2.2 The leadwires should be attached to the instrument while the numbered control knob is in the *OFF* position. See Section 7.1 for instructions on the use of gelled electrodes.

2.3 The **MICROSTIM *PLUS*** can also be used with *Ball Probe Electrodes* which are provided with the instrument. These electrodes plug into the *RED* and *BLACK* jacks and are convenient for use in both the Operating Room and Recovery Room when one does not wish to use the gelled electrodes and leadwires.

3.0 FAMILIARIZATION WITH CONTROLS

3.1 Power is applied to the instrument by rotating the *control knob* located on the left side of the case in a clockwise direction until an audible click is heard. When the unit is first turned *ON*, it will be in the standby mode and no pulses will be generated. The numbered *control knob* is used to adjust the amplitude of the output current. The output current value will be in the range of 0 to 70 mA (milliamperes) which corresponds to the numbers between the *OFF* and the Number 10 position on the knob. The numbers on the knob serve as a convenient reference for remembering the approximate settings of the output amplitude.

3.2 The four touch-switches (buttons) located on the front panel provide a convenient means of controlling the functions of the instrument. They are operated by using a finger to depress the desired function designated under each of the four buttons. Each time a pulse is generated, the *Pulse LED* will *flash* and an *audible click* will be heard.

3.3 The *DBS* button will automatically generate a single set of *Double Burst Pulses* (*DBS* 3,3). The *DBS* function can be repeated as often as one wishes by depressing the *DBS* button.

3.4 The *Twitch* button when depressed and held down produces 1 pulse every second continuously until the button is released.

3.5 The *Tetanus* function is momentary and will produce tetanic stimulation as long as the button is held down. The tetanus frequency is set at the factory for *100 Hz*. However, the frequency can be changed to *50 Hz* by the following procedure: Remove the battery cover and take the battery out of the instrument. Inside the battery compartment you will find a small slide switch marked *50 Hz* and *100 Hz*. Move the slide switch to the desired tetanus frequency, reconnect the battery, and replace the battery cover. The instrument is now ready to use.

3.6 The *TOF* (Train-Of-Four) button, when momentarily depressed, will automatically generate four pulses in a period of two seconds. The train-of-four pulses can be repeated as often as one wishes by depressing the TOF button again.

4.0 INDICATORS
4.1 The *Pulse LED* will *flash RED* each time an output stimulus pulse is generated.
4.2 An *audible click* will be heard each time an output stimulus pulse is generated. This enables the user to verify that the unit is stimulating without observing the *Pulse LED*.
4.3 The *Battery LED (green)* will normally be *ON*. When the battery voltage drops to approximately 6.0 Volts, the *Battery LED* will begin *flashing*. The battery should be replaced at that time.

5.0 OUTPUT JACKS
5.1 There are two output jacks located on the front end of the instrument case. Their colors are *RED (+)* and *BLACK (-).* The output can deliver (with a fresh battery) approximately 70 mA into a 2000 Ohm load.
5.2 The *BLACK (-)* jack is the negative output or common. The leadwire with the *BLACK* plug should be connected to the BLACK (-) jack.
5.3 The *RED (+)* jack is the positive output. The leadwire with the *RED* plug should be connected to the *RED (+)* jack.
5.4 The *Ball Probe Electrodes* can also be used with the **MICROSTIM *PLUS*** by plugging them into the *RED* and *BLACK* output jacks.

6.0 BATTERY REPLACEMENT
The battery is easily replaced by turning the instrument over and removing the battery cover, unsnapping the old battery and snapping in a fresh one. The battery should always be replaced with a 9 volt *alkaline* battery. The instrument will operate satisfactorily down to a battery voltage of approximately 6.0 volts. At this voltage level, the *Battery LED (green)* will begin *flashing*. When the *LED* starts *flashing*, the instrument can still be used, but the battery should be replaced as soon as possible.

7.0 APPLICATION NOTES (monitoring of neuromuscular function)
7.1 **LEADWIRE ATTACHMENT WHEN USING GELLED ELECTRODES**
The leadwire with the *BLACK* plug should be plugged into the *BLACK (-)* jack located on the front end of the instrument case and the leadwire with the *RED* plug should be plugged into the *RED (+)* jack. Gelled electrodes should be placed in line with and over the ulnar nerve. The distal (negative) electrode should be placed at the level of the proximal flexor crease of the wrist. The electrode pair should be placed directly over and parallel to the flexor carpri ulnaris tendon.
7.2 **BASELINE ADJUSTMENT**
Before any muscle relaxant is administered, the instrument should be adjusted to provide *Supramaximal Stimulation (SMS)*. *SMS* is defined as the level at which additional stimulation current does not increase twitch response. This setting can be approximated by adjusting the control knob to the level where any further increase in stimulus current would not increase the level or height of the twitch response. Note the number on the *control knob* and maintain this baseline setting throughout the entire procedure.
7.3 **TWITCH RESPONSE**
The simplest test provided by the *PNS* is the twitch response where individual stimuli are generated at intervals of one to ten seconds. Shortly after administering the muscle relaxant, the twitch response will start to become depressed. At this point more than 70 percent of the receptors should be blocked. When the twitch is completely eliminated, greater than 90 percent of the receptors are occupied by the relaxant. The twitch can be used as a quantitative monitor by adjusting the muscle relaxant administration to maintain a faint, but perceptible muscular contraction (twitch) in response to the *PNS*. This assures adequate operating conditions while avoiding excessive relaxant administration. In the event the twitch has been abolished by an inadvertent relaxant overdose, if one waits until the twitch reappears before administering subsequent relaxant, the incidence of failure of reversal can be minimized.
7.4 **TETANIC STIMULI**
When the single twitch response has returned to normal, approximately 20 percent of the receptor pool is free. Fortunately, the diaphragm needs fewer receptors available to respond normally than do peripheral muscles. This can be observed clinically in that spontaneous respiration may be detected before an indirectly stimulated response. However, a patient with 80 percent receptor block may still need to be carefully monitored. Thus, it is important to have a means of assessing when recovery has proceeded to a more adequate level. It was to this end that the tetanic stimuli evolved. This is the administration of *50* or *100 Hz* stimuli for a period of approximately 5 seconds duration. The higher frequency puts a greater demand on the neuromuscular synapse because as each successive stimulus arrives at the nerve ending, it depletes the local store of transmitters so that the amount of acetylcholine available for

release by each succeeding stimulus falls. When the fraction of free receptors is also decreased, the tetanic response does not maintain its initial intensity; it fades. The higher the rate of tetanic stimulation, the more sensitive the test. Fade can be detected at *100 Hz* when as few as 50 percent of the receptors are occupied and at *50 Hz* when as few as 70 percent of the receptors are occupied. Unfortunately, tetanic stimuli are painful and are therefore of limited value in detecting subtle neuromuscular blockade in the unanesthetized patient.

7.5 **TRAIN-OF-FOUR**

In the *Train-Of-Four (TOF)* test, the ulnar nerve is stimulated with four supramaximal stimuli 0.5 second apart and the ratio of the fourth twitch to the first twitch is used to determine the degree of neuromuscular block. The primary advantage of *TOF* is that the first response provides a built-in control for the fourth response. Built-in control is a great convenience in the clinical setting in which factors such as patient movement can change the initial tension of the muscle and hence the amplitude of the twitch response. A good rule of thumb is that the degree of block may be estimated by counting the number of twitches seen following the four stimulus pulses. When only one twitch is present, there is greater than 90 percent block. All four twitches appear when the single twitch is depressed by 75 percent. Recovery from the block occurs when all four twitches in the train are the same height. At this time, about 25 percent of the receptor pool is free. Thus, *TOF* is a slightly more sensitive test than the twitch.

7.6 **DOUBLE BURST STIMULATION (DBS 3,3)**

This pattern of stimulation consists of two short tetanic bursts (50 Hz for 60 msec) separated by .75 second. It is easier to see fade when using *DBS* than when using *TOF* since *DBS* is more sensitive than *TOF* in the normal detection of residual neuromuscular blockade. During the postoperative period and recovery, evaluation of the response to *DBS* has been shown to be superior to evaluation of the response to *TOF*.

8.0 SPECIAL CONSIDERATIONS AND CONTRAINDICATIONS

8.1 **EXPLOSIVE ATMOSPHERES**

This device is a possible explosion hazard if used in the presence of flammable anesthetic gases.

8.2 **MICROSHOCK HAZARD**

This device may be hazardous to patients with pacing catheters. If used on such patients, exercise extreme caution to prevent the nerve stimulator output leadwires from contacting the pacing catheter or catheter leadwires. Patients with an implanted electronic device (for example a cardiac pacemaker) or cardiac abnormalities should not be subjected to stimulation unless a specialist's medical opinion has first been obtained.

8.3 **NEEDLE ELECTRODES**

Because of the small surface area and low current values required when using percutaneous (needle) electrodes and the potential for high current density and possible needle burns, it is recommended that needle electrodes *not be used*.

The **MICROSTIM *PLUS*** is not intended to be used for nerve location. Contact Neuro Technology for special products designed for this application.

8.4 **USE WITH H.F. SURGICAL EQUIPMENT**

Simultaneous connection of a patient to h.f. surgical equipment (i.e. electrocautery/electrosurgical units) may result in the electronic gating mechanisms in the nerve stimulator being overridden by the cautery pulses causing stimulus pulses to be generated by the stimulator. Simultaneous connection may also result in burns at the site of the stimulator electrodes and possible damage to the stimulator.

8.5 **USE WITH SHORTWAVE OR MICROWAVE THERAPY EQUIPMENT**

Operation in *close proximity* to a shortwave or microwave therapy unit may produce instability in the stimulator output.

8.6 **SKIN BURNS**

Use of *tetanic* stimulation for prolonged periods of time may result in skin burns. The stimulus current should be gradually increased until supramaximal stimulation is achieved. *Use of current levels higher than required for supramaximal stimulation increases the risk of skin burns.*

8.7 **TETANIC STIMULATION**

Tetanic stimulation may be uncomfortable for fully conscious patients. Therefore, it is recommended that twitch or trainof- four be used which are better tolerated in awake patients.

9.0 SPECIFICATIONS

9.1 **BUTTON FUNCTION FREQUENCY**

Double Burst (DBS 3,3)……50 Hz for 60 msec separated by .75 second.
Twitch……1 pulse per second
Tetanus..…….50/100 Hz (user selectable)

Train-Of-Four (TOF)…….4 pulses per 2 seconds.
9.2 **PULSE CHARACTERISTICS**
Pulse Width……..200 Microseconds
Pulse Type……...Square Wave Monophasic
9.3 **OUTPUT CURRENT**
RED output……0 - 70 mA
9.4 **DISPLAY/LED/AUDIBLE INDICATORS**
Pulse LED: *Flashes RED* each time a pulse is generated.
Stimulus Pulse: An *audible click* will be heard each time a stimulus pulse is generated.
Battery LED: Normally ON (green). Flashes when battery voltage is low.
9.5 **POWER**: One nine volt alkaline battery.
9.6 **POWER CONSUMPTION**: Approximately 13.0 mA
9.7 **CASE**: High impact ABS plastic
9.8 **SIZE**: 1.10”H x 2.42”W x 3.88”D
9.9 **WEIGHT**: 5.5 oz. Including battery.

10.0 **STERILITY:** Non-Sterile

11.0 **SERVICE LIFE:** The service life of this device is 3 years from date of purchase.

Limited Warranty
Neuro Technology, Inc. products are guaranteed against defects in materials and/or workmanship when used in normal service for One Year from date of delivery to the original purchaser. Adjustment and/or repair without charge will be made during the one year warranty period only if the instrument in question has not been abused, tampered with, or subjected to unauthorized repair. Damage due to fire, lightning, negligence, water and other liquids, excessive pressure or misuse are not covered under this warranty. Warranty inquiries and requests for warranty repair should be made directly to:

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